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**UNU-IAS**

**Water and Urban Initiative**  
**Working Paper Series**  
Number 04 — April 2015



# Overview of Jakarta Water-Related Environmental Challenges

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## **Water and Urban Initiative**

This working paper series shares findings produced as part of the research activities under the Water and Urban Initiative (WUI), a research project of the United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS). The WUI aims to contribute to sustainable development, focusing on developing countries in Asia, by providing policy tools and an information platform to assist planning and implementing policies for sustainable urban and water environment.

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**ABSTRACT**

Jakarta, located on the northwest coast of Java, is the economical, political and cultural capital of Indonesia. The Metropolitan area, Jabodetabek (Jakarta-Bogor-Depok-Tangerang-Bekasi), is the 6th largest metropolitan area in the world with a little under 20 million people. About 9 million people live in Jakarta it self, in an area of 660 km<sup>2</sup>. 13 Rivers intersect the city and every year floods occur in Jakarta. Widespread flooding occurred in 1996, 2002 and 2007, inundating up to 40% of the city. Increasing population pressure and soil subsidence (10 cm/year or more) of areas already under mean sea level lead to an autonomous increase of flood risk. In addition, subsidence causes the Jakarta sea defense to sink below critical levels and has major impact on the quality of live in the city. Additionally, all the rivers in Jakarta relatively are heavily polluted. Rivers in Jakarta have been monitored on a regular basis, and consistently show high BOD readings. The sources of BOD in Jakarta’s River system originate from industrial and other waste water, solid waste, and domestic sewage. High pollution levels cause treatment costs to increase. All surface waters crossing Jakarta are heavily polluted by gray water from households, commercial buildings, together with discharges from industries, pesticide and fertilizer run-off from agricultural land, solid waste, and fecal matter from overflowing or leaking septic tanks. As summary, Jakarta faces common environmental problems like other megacities do. However, the variation of capacity of the city municipality that makes the different results. While several improvements have been made, the environmental problems have become really huge. Without proper plans, and coordination and actions for environmental management, Jakarta will have difficulties to sustain for the future.

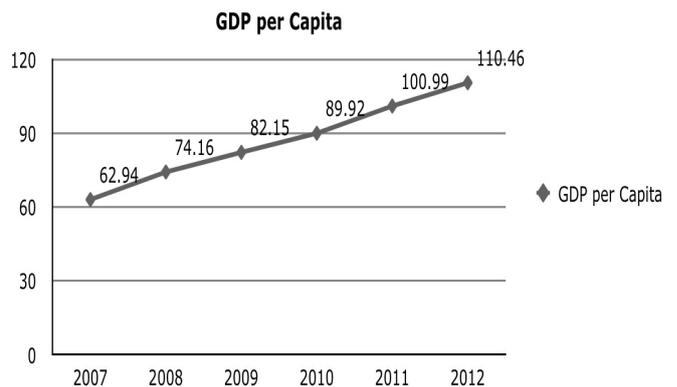
*Keywords: Jakarta; environmental challenges; water quantity and quality; water treatment*

**1. Introduction**

Jakarta officially known as the Special Capital Region of Jakarta is the capital and largest city of Indonesia. Jakarta City, located on the northwest coast of Java Island at the mouth of the Ciliwung River on Jakarta Bay which is an inlet of the Java Sea, is the economical, political and cultural capital of Indonesia. Officially, the area of the Jakarta Special District is 662 km<sup>2</sup> (256 sq mi) of land area and 6,977 km<sup>2</sup> (2,694 sq mi) of sea area. Jakarta is administratively equal to a province with special status as the capital of Indonesia. It has a governor. As a province, the official name of Jakarta is Daerah Khusus Ibukota Jakarta (“Special Capital City District of Jakarta”), which in Indonesian is abbreviated to DKI Jakarta. Jakarta is divided into five kota or kotamadya (“cities” – formerly municipalities) (Figure 1).



**Figure 1:** Map of the municipalities (kotamadya) in Jakarta province



**Figure 2:** The GDP per capita of Jakarta

The national capital of Indonesia, Jakarta, has faced tremendous urban development and changes. Housing development has been increased due to economic boom between 1972-1990s. These economic booms caused very massive urban development to the surrounding cities of Jakarta, such as Bogor, Depok, Tangerang and Bekasi. Despite economic crisis in mid of 1990s, the city regain its economic momentum from early 2000s (Figure 2).

Ultimately, built up areas in Jakarta has increased through both formal businesses and settlements as well as non-formal businesses and settlements. Within these periods, Jakarta’s population has increased from about 8.3 millions (2000) into 10,075 million (2014) as shown in Figure 3. This inczease has not been supported by the increases of environmental service capacities to support the consequence of the development. Thus, environmental problems

related to clean water provision, waste water production and treatment as well as disasters such as flooding and land subsidence, have become commons in Jakarta. While some responses and activities have been conducted by the municipality, the environmental challenges tend to be bigger than the capacities of the municipality alone. This writing highlights these issues in the detail in the rest of the sections.

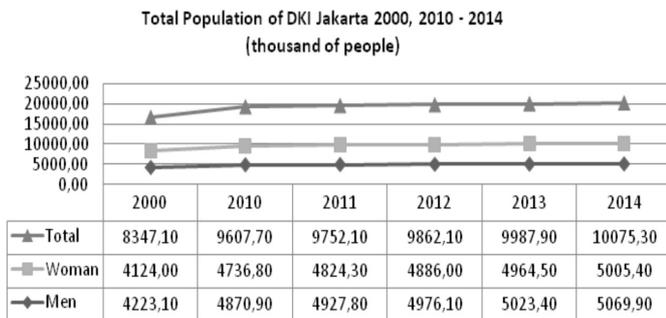


Figure 3: Total population growth of DKI Jakarta Province during 14-year.

## 2. Land Use Development of Jakarta

Urban Jakarta has had limited green areas as the negative impact from an immense development of high-rise, residential, and other commercial buildings until mid of 1990s (Rukmana, 2015). The percentage of green space in the Jakarta spatial plans has decreased from 27.6% in Jakarta Master Plan 1965–1985 and 26.1% in Jakarta Spatial Plan 1985–2005 to 13.94% in Jakarta Spatial Plan 2000–2010 (Rukmana, 2015). WALHI, a national Indonesian environmental NGO, has identified at least five areas designated green areas in the Jakarta spatial plan 1985–2005 have been converted into built up areas, among others settlements, commercials and shopping malls. Finally, in 2013 Jakarta has only about 10,008 hectares (9%) of green areas from the original amount in 2007 which amounting to 33,467 (29%).

## 3. Water Demand and Supply in Jakarta

Water demands can be categorized for domestic and non domestic use in Jakarta. In the last one decade, domestic (settlements) demand's in Jakarta has increased from 243 million m<sup>3</sup> to about 294 million m<sup>3</sup> (Veldhuis, 2014). Figure 4 shows the estimate calculation of water demands in Jakarta.

The most common water source for Jakarta mainly comes from water purification from Citarum River and from other areas outside Jakarta, such as Jatiluhur Dam (Figure 5). The second water source option is groundwater. Unfortunately, groundwater was not very dependable water source for domestic needs. There is only limited amount of groundwa-

ter in Jakarta, and to access that water for domestic uses, people have to compete with private sector that has done a major abstraction for their industrial activity.

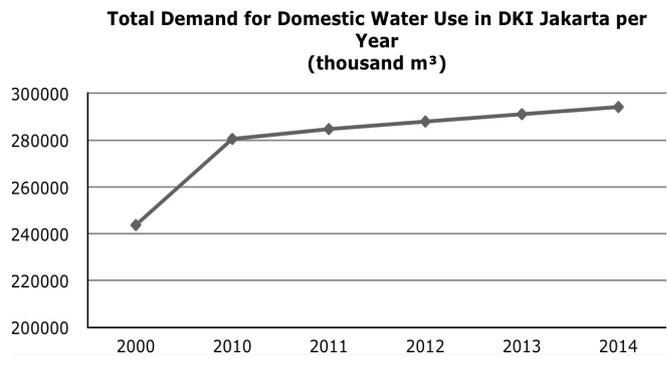


Figure 4: Calculate water demand for domestic sector in DKI Jakarta (2000-2014). (Source: Palyja (2011))

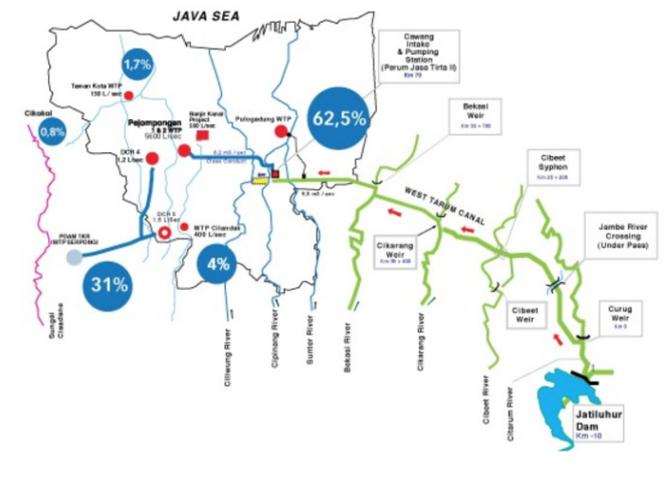


Figure 5: Water supply from Citarum river (Jatiluhur Dam) to Jakarta City.

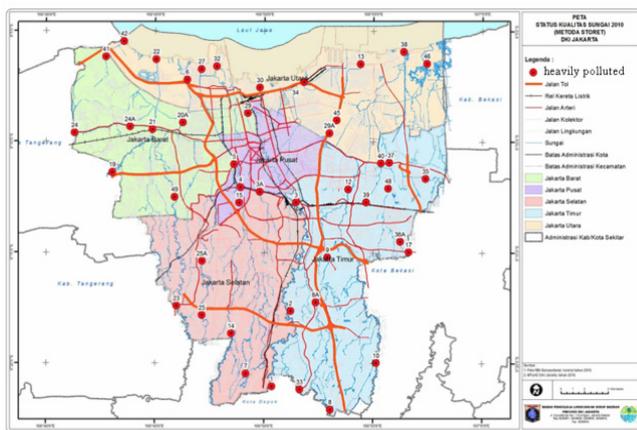
## 4. Waste Water

Wastewater is another water management issue that needs to be considered more thoroughly. Higher population density and their activity not only affect the water supply and demand, but also the production of waste water released to the river or open channel. There is still 75% of remaining waste water that needs to be treated in Jakarta. However, this amount of waste water is still released directly into the rivers. More than 50% of the shallow wells have contaminated by E. coli that comes from domestic waste water, and more than 10% of shallow wells also has contaminated by iron and manganese (Tutuko, 2002). Based on BPLHD Pollutant Index from 2004-2009, most of the river water quality in Jakarta were highly polluted. Although in 2007 to 2008 there was a decreasing of polluted river water percentage, but generally the river water in Jakarta were still highly polluted (Table 1).

**Table 1: River water quality in Jakarta (Source BPLHD (2009))**

Quality Status	Pollutant Index					
	2004	2005	2006	2007	2008	2009
Good	0%	0%	3%	0%	0%	0%
Low Polluted	3%	5%	9%	0%	0%	9%
Moderate Polluted	16%	16%	10%	6%	12%	9%
High Polluted	81%	79%	78%	94%	88%	82%
<b>Total</b>	100%	100%	100%	100%	100%	100%

Additionally, all the rivers in Jakarta are heavily polluted. Rivers in Jakarta have been monitored on a regular basis for the past ten years, and these findings consistently show high BOD readings. The sources of BOD in Jakarta’s River system originate from industrial and other waste water, solid waste, and domestic sewage. High pollution levels causing treatment costs to increase. In 2010, all surface waters crossing Jakarta are heavily polluted by gray water from households, commercial buildings, together with discharges from industries, pesticide and fertilizer run-off from agricultural land, solid waste, and fecal matter from overflowing or leaking septic tanks (see Figure 6).



**Figure 6: Map of water pollution status in the rivers of Jakarta City in 2010.**

Different from ground water case in Jakarta, pollutant index shows that from 2004-2009, most of the ground water quality was low polluted. Unfortunately, even though ground water has better quality water comparing to river water, ground water volume was limited to meet the needs of water use in Jakarta.

In Jakarta, there are 11,800,000 populations for waste water treatment (including floating population) and 9,900,000 if only the actual population. Waste water treatment divided into off-site (sewerage) and on-site sanitation (PD PAL JAYA, 2012). On-site sanitation was mainly used in

residential and slum area. About 8,4 million populations in Jakarta (71%) treat their waste water using individual septic tank before release the waste water to the sewerage. About 1,300,000 populations (11%) in slum area will directly deliver their waste water into the river. Off-site sanitation was used by mainly apartment, office buildings, and industry in Jakarta. There are 1,900,000 of population (16%) using individual treatment plant (ITP) and some using individual treatment plant with advanced treatment process (ATP) before the waste water was delivered into the river. There are also 200,000 of population who use off-site sanitation by delivered their waste water through sewerage into Pumping Station and Setiabudi WWTP.

**Table 2: Ground water quality in Jakarta (Source: BPLHD (2009))**

Quality Status	Pollutant Index					
	2004	2005	2006	2007	2008	2009
Good	18%	16%	7%	25%	23%	23%
Low Polluted	33%	33%	55%	43%	48%	41%
Moderate Polluted	28%	35%	13%	20%	16%	19%
High Polluted	21%	16%	25%	12%	13%	17%
<b>Total</b>	100%	100%	100%	100%	100%	100%

### Waste Water Treatment

There is a sewerage system in the cities, but they are inadequate and not well maintained. Sewerage system is usually directly connected to the rivers acrossed the city. Though there are some waste water treatment systems, most of them are not functioning well. The rising demand for water and in the Jakarta Province has put pressure on the quality of water. The quality of both surface and ground water has deteriorated and scientific study for the urban water environment of Jakarta Capital City has become essential. Jakarta Province Government currently manages two Septic tank Waste Treatment Installation (IPLS) that hold 300 m<sup>3</sup> of their capacities, which are IPLS Pulo Gebang and IPLS Duri Kosambi. The monitoring report shows that both of IPLS currently have ineffective and inefficient operation due to the advance of technology nowadays, there is no further septic tank waste process so the waste can be used as energy resources for example, IPLS capacity cannot meet the needs of the population, and current IPLS technology spends a lot of cost and time (DKI Jakarta Province Government, 2013). Wastewater management issue deals with a comprehensive team work between government, professional companies, and community is needed.

## 5. Law, Policies, and Management Set-up Regarding Water Pollution

Water pollution in Jakarta occurs because of limited amount of housing or buildings that equipped with WWTP

(Waste water Treatment Plant). It has been reported that only 4% of housing in Jakarta have WWTP and he considers to create local regulation regarding WWTP permit for housing construction (Faris, 2013). Water pollution control was regulated in Indonesian Government Regulation No. 82 of 2001 regarding water quality management and water pollution control. In accordance to the regulation, national government is responsible for pollutant load capacity identification, source of pollution inventory and identification, waste water requirements determination for ground application, waste water discharge requirement determination, water quality monitoring in water sources, and water sources quality changes monitoring. Those all will become supporting tools for building construction permit, water source management, spatial planning of Jakarta, waste water discharge permit, and water quality identification. The responsibility of national government can be disposed to province and city government. The province government will be responsible for cross-city water pollution, the city government will be responsible for cross-district water pollution, and lastly the district government will be responsible for water source pollution in its area. Usually, government has its specific agency to manage their water pollution problems more thoroughly, such as Ministry of Environment on national scale and BPLHD on province scale. For monitoring purposes, province and municipal governments are required to provide reports to the Ministry of Environment at least one report every year. Province Government also created a regulation regarding waste water retribution for every amount of waste water discharged into the water source. They also have EIA Review Commission of DKI Jakarta Province to assess the waste water condition before allowing them to discharge the waste water into the water source, which is why the waste water needs a treatment before it got discharged.

## 6. Summary

- Jakarta is the capital of Indonesia and is situated on the island of Java. Jakarta is a part of a big city region consisting of various cities with a total of 25 million inhabitants, the city of Jakarta has an estimated population of 8,6 million. The land surface of Jakarta is heavily populated and has many environmental challenges to face. Among them are the land-water pollution, rapid land-use change and ecosystem degradation.
- The Jakarta situation today needs improvements. The citizens have an unsatisfactory access to clean drinking water, there is no sewage system for the greater part of the population and on top of this the city is suffering of water scarcity especially in the dry season.
- A big part of the population don't have access to piped water which means that they either have to buy expensive bottled water or take water of bad quality from the rivers and wells in the city. The lack of clean

water result in that a majority of the population is suffering from diseases caused by water parasites. The city has no proper sewage system and most citizens' don't have an indoor plumbing system. This means that they use the rivers and the public canals for washing, bathing and dumping garbage which causes great sanitary problems.

- Jakarta is a heavily polluted city but by making the sewage, water, and garbage treatments more efficient and more environmental friendly will make it a more sustainable and healthier city. This will of course cost a lot of money, but it could be considered as a long term investment that will give the city and its inhabitants work opportunities, better health and a better environment.

## 7. Acknowledgments

The financial and administrative supports received from the Water and Urban Initiative (WUI) Project (United Nations University - Institute for the Advanced Study of Sustainability (UNU-IAS) in association with funding from Ministry of the Environment, Japan) and the Research Centre for Limnology-Indonesian Institute of Sciences (LIPI) are gratefully acknowledged.

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